Large Air Release Response
Session I - Data Panel
Laboratory Perspective
Gas and Vapor Air Releases

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Laboratory investigations and analysis for the *assessment, control, and prevention* human exposure to toxic chemicals.

Outdoor Air Quality - innovative laboratory methods research to elucidate sources of human exposure to airborne toxicants in the outdoor environment.

Chemical Agents Identification - development of protocols and standard instrument operating procedures to characterize a potential chemical threat agent.

1.Characterize Air Release (site monitors, modeling, environmental transformation)

- Laboratory sampling and analysis recommendations rely on accurate and timely site information
- 21 Site evaluation questions developed for immediate assessment of potential Laboratory role in designing sampling and analysis strategy
- Source chemicals, first responder measurements, site visuals, meteorology, and plume modeling essential to start planning response
- Environmental transformation assessment to determine chemical composition of plume and physical state (gas, vapor, particle)

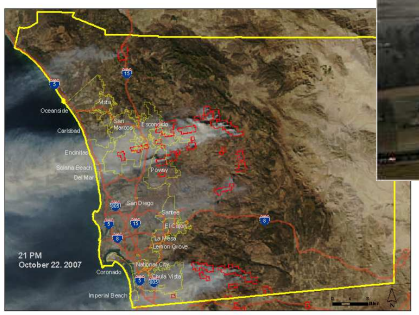
Rural Wildfire

Urban Train Tanker Fire

White phosphorous tanker fire

2. Sample Collection Strategies (Acute and Chronic Phase)

- Sample collection sites choice will be determined by the phase of the incident, scale of the air release, and candidate toxic gases and vapors
- Acute phase is driven by identification of the toxic threat and rapid deployment of samplers available, while chronic phase emphasizes public exposure and air model verification
- Large scale releases require sampling at area population centers, while for smaller scale releases the plume touch down area is paramount
- Candidate toxic gases and vapors, and their transformation products drive sampler choice and analysis method



Air Basin Scale Impact

Community Scale Impact

Neighborhood Scale Impact

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3. Sampling methods (cans, tubes, bags…) as they relate to the analytical technique.

- Gas/vapor sampling for Laboratory analysis employ (1) capturing a volume of ambient air or (2) collecting the toxicant from a volume of air
- Capturing an air volume using an evacuated canister or Tedlar bag does not require specific knowledge of the release composition
- Both canisters and bags require concentration of the volatiles from the air sample just before analysis, but canisters offer better containment
- Solid sorbent tube, diffusion badge, and coated filter sampling requires knowledge of the toxicant; chemical artifacts in sampling and analysis
- Canisters and badges are self contained systems, while bags, tubes, and coated filters require an air sampling pump and flow control

Evacuated Canisters

Diffusion Badges

Tedlar Bags

Sorbent Tubes

Coated Filters

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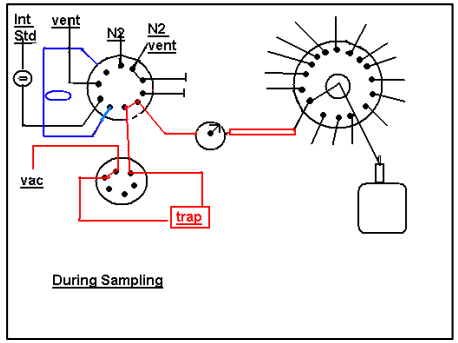
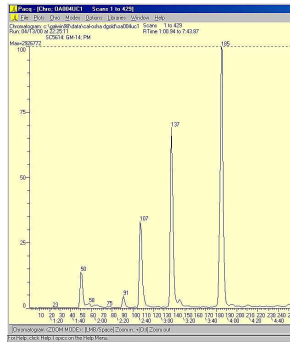
4. Laboratory methods (bench and mobile), (analytical methods, procedures, and techniques and platforms); analytical tools specific limitations, key quality control items

- Primary instrument for analysis of gas/vapor toxicant samples is the GC/MS, which allows library matching for identification
- GC/MS analysis can be performed in the Mobile Laboratory on-site using extract of sorbent tube or processing of air sample canister similar to a Central Laboratory
- Mobile Lab requires more effort for sustained field presence, but allows more direct interaction with field sample collection operations
- Mobile Lab requires data link with Central Lab to support data transfer and automated QA/QC procedures to qualify the results

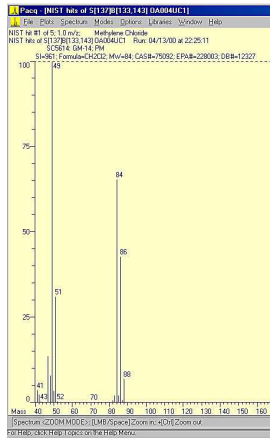
Chemical Vapor Identification and Quantification



Canister Sample Processing



Gas Chromatography (GC)



Mass Spectrometry (MS)

5. On site v. central laboratories, standard methods versus portable methods, comparability of results among instruments

- Portable sensors are valuable for screening for classes of gas/vapor chemical threats, with a few capable of specific threat identification.
- Central Laboratory offers the advantages of standard methods including QC samples and exact identification using GC/MS library matches.
- Central Lab analysis allows more thorough and rapid sample screening to validate field screening for multiple threats (Chem, Rad, Bio)
- Mobile Lab can project Central Lab analytical capabilities to the field site to allow verification of portable sensor data
- Mobile Lab is the most valuable asset during the acute incident phase, at downwind community sites where exposure assessment is primary

Mobile Lab Screening and Analysis

Criteria Air Pollutants

Chemical Sensor Sample Transporter

Central Lab Screening and Analysis

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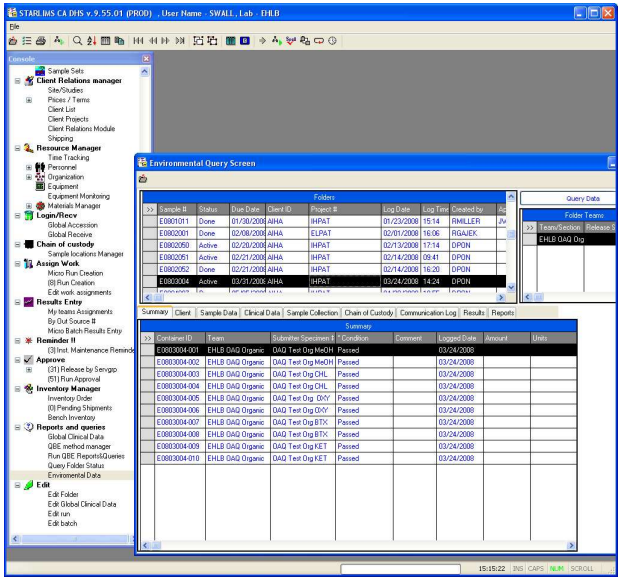
6. Data storage/management: sample averaging times, levels of detection, ease of use, data review, and access to information.

- Integrated Laboratory Information Technology System is essential for both Central and Mobile Laboratories in order to automate the sample collection, tracking, analysis, results approval, and reporting
- Laboratory Information Management System (LIMS) pre-configured to link the gas/vapor toxicant release to the appropriate sampling and analysis methods, and the associated Laboratory resources required
- LIMS stepwise work flow control from required sample collection data, chain of custody, storage requirements, sample preparation and analysis, QC review, results reporting, and data transmittal steps

LIMS linkages:

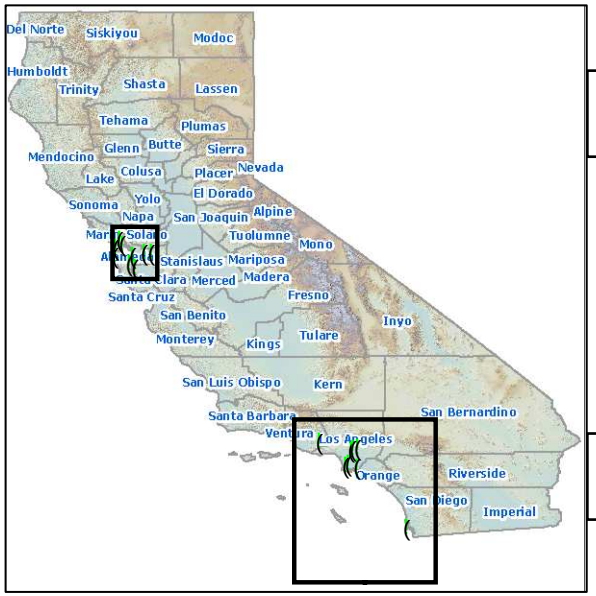
- Web-based remote sample log-in and results reporting with assess control
- Instrument analysis data upload from Mobile or Central Lab
- Geo-coding of sampling location and results
- Management of sample aliquot distribution and sub-sample results comparison.
- Comparison of chemical sensor data and laboratory sample analysis



Laboratory Information Management System

7. Availability of assets, overall flexibility/versatility, level of acceptance/use within emergency response

- Federal, state, and local government and commercial Laboratory resource identification by sampling and analysis capabilities and certifications
- Geo-coded mapping data base to quickly identify sampling supply and Laboratory resources near the incident site, but outside the release impacted area
- Coordination and planning with other agencies for effective use of Laboratory resources for assessing the potential for toxic gas/vapor exposure as an essential part of incident response



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Filter by location, Field of Testing, Method, Analyte

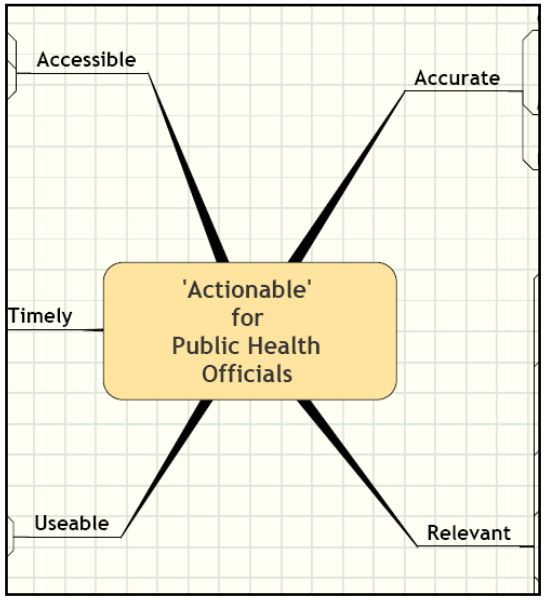
8. Actionable (accessible, timely, usable, accurate, relevant, and easily understood) for public health officials features that translate output to a specific health index.

- Field sampling and Laboratory analysis of gas/vapor toxicants to produce actionable information
- Requires bi-directional linkage with the other elements of "Data Acquisition" (Monitoring, Modeling) and a working knowledge of the requirements of Data Management and Presentation

Web-based LIMS

Differentiate Acute and Chronic Phase Requirements

Pre-determined Requirements Across Disciplines



Define Elements of "Sufficiently Accurate" for decision making

Health Impact Target